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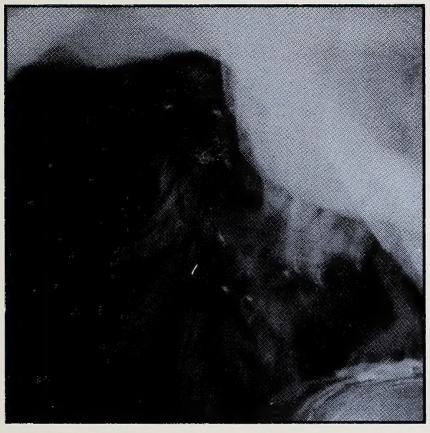
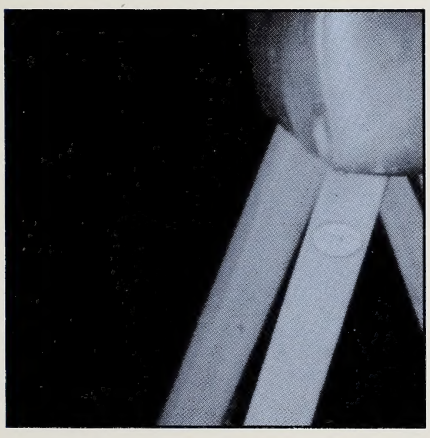
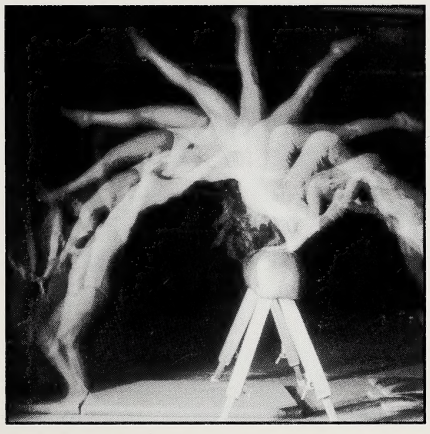
MODULE 4: TECHNOLOGY FOR LIFE



MODULE 4: TECHNOLOGY FOR LIFE
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Science 14

Module 4

TECHNOLOGY FOR LIFE

Alberta
EDUCATION

Science 14
Student Module
Module 4
Technology for Life
Alberta Distance Learning Centre
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turn on your audiocassette and listen.

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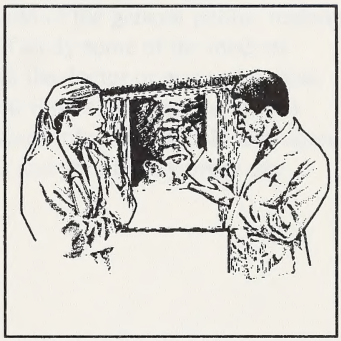

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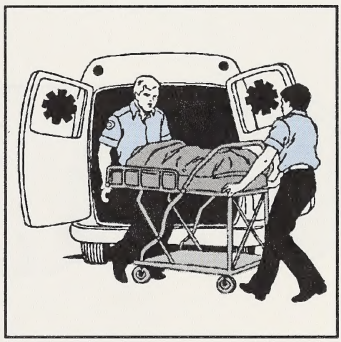
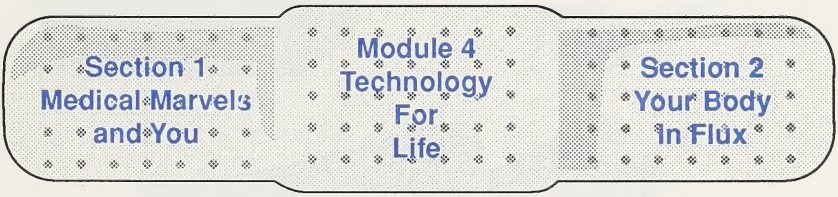


OVERVIEW

How many times have you reached for an aspirin, put iodine on a cut, or had a chest x-ray? These are all helpful products and devices that improve your health. Aspirin, iodine, and x-rays are examples of the application of science and medical technology.

Medical technology has made it easier to find, identify, and cure potential diseases. The development of antibiotics, vaccines, and numerous therapeutic drugs is the result of science and medical technology. These developments have improved the overall health of the general public, making life easier to endure. In this module you will study some of the modern technology that you might see when you visit the doctor or go to a hospital. You will learn how to determine your general fitness level and be able to compare your findings to a set of norms or standards. You should also come to appreciate how medical science helps you and your family every day.

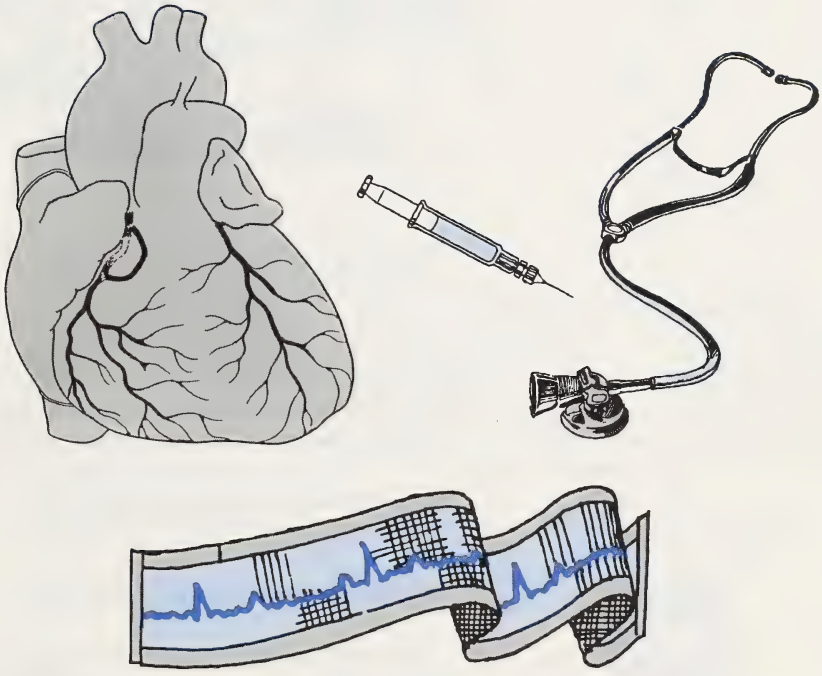


Evaluation

Your mark in this module will be determined by your work in the Assignment Booklet. You must complete all assignments. In this module you are expected to complete two section assignments. The assignment breakdown is as follows:

Section 1	=	50 marks
Section 2	=	50 marks
TOTAL	=	100 marks

1 Medical Marvels and You



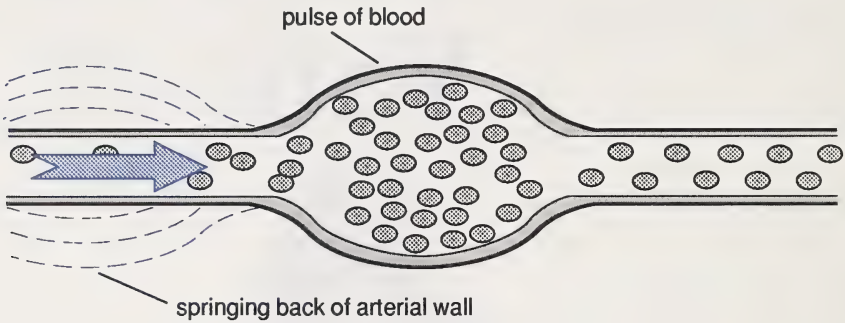
Have you been to the doctor lately or spent some time in the hospital? A tour of the x-ray department, medical laboratory, or operating room will give you an idea of the complex technology being used to keep you healthy. Medicine now depends on research scientists, technicians, and computer experts to aid in the diagnosis and treatment of illness.

In this section you will examine some of the medical technology used for testing the fitness of various body systems. You will start this section by performing some exercises to evaluate your own general state of fitness.

Activity 1: Do It Yourself?

pulse - the surge of blood in the arteries when the ventricles of the heart contract

One of the first tests any doctor will do when you come in for a check-up is the taking of your **pulse**. Blood surging through the arteries causes a bulging of the artery walls. As the blood passes, the artery walls spring back to normal, helping to move blood along in the arteries. Each surge of blood in the arteries is known as one pulse.



Your pulse rate, the number of bulges per minute, gives you an accurate measure of your heart rate.

Your doctor uses your pulse rate as one method of determining your general health. A high pulse rate means your heart is working too hard to pump your blood. A lower heart rate usually means you are in good shape and your heart is not working as hard to pump your blood.

The following investigations should help you determine what kind of shape you're in.

Investigation: Taking Your Pulse

You can feel the blood surging through the arteries which are close to the surface of your skin. Each time your ventricles contract, a pulse is produced in your arteries. The following is one method for taking your pulse.

Materials You Need

- watch or clock with a sweep second hand

Steps to Follow

STEP A

Sit down at a desk or table and relax for a moment. Make a fist with your left hand and place the index and middle fingers of your right hand on your left wrist.

STEP B

With your left hand still clenched, position the fingertips of your right hand just above the left tendon ridge. Unclench your fist and press lightly with your right fingertips. Move your right fingers a little until you feel a strong pulse.

STEP C

Once you have found your pulse, relax and breathe normally. You will now take your resting heart rate to determine how hard your heart is working when you are relaxed.

STEP D

Use a watch or a clock with a sweep second hand to count the number of heartbeats over a period of 10 seconds.

Take this number and multiply it by six. This will give you your heart rate for 1 minute.

_____ × 6 = _____
beats per minute

STEP E

Repeat step D six times and complete the chart on the right.

OBSERVATION

Resting Heart Rate

Trial	Number of beats in 10 seconds	× 6	Beats/minute
1		× 6	
2		× 6	
3		× 6	
4		× 6	
5		× 6	
6		× 6	

STEP F

Calculate your average resting heart rate by adding the number of beats per minute for all six trials and dividing this total by the number of trials.

Resting Heart Rate =

$$\frac{\text{Total beats per minute for all trials}}{\text{Number of trials}}$$

= _____

Conclusions

1. In this investigation you took your pulse for a total of six trials. Why didn't you just use one trial to find your resting heart rate?

_____

_____

_____

_____

_____

2. Explain why the resting heart rate gives you a rough idea of your general fitness level.

_____

_____

_____

_____

3. Would you expect your resting heart rate to increase, decrease, or stay the same after three weeks of a strenuous exercise program? Explain your answer.

_____

_____

_____

_____

_____

Check your answers by turning to the Appendix, Section 1: Activity 1.

Your resting heart rate should be close to 72 beats per minute. A higher resting heart rate could be the result of stress, sickness, or a general lack of fitness. You may be nervous about something, out of shape, or ill with a cold. A resting heart rate below 70 beats per minute means that you are either very relaxed, in good physical shape, or on some kind of medication. For a correct diagnosis you should see a trained physician.

diagnosis - the educated opinion of a doctor explaining what is wrong in your body

Did You Know?

The average male has a heart rate 5 to 10 beats lower than the average female. This is because females carry more essential body fat than males do.

Investigation: Your Working Heart Rate

Have you ever run so hard that it felt like your heart was ready to burst right out of your chest? Or have you ever been so frightened or nervous that all you could hear was your own heart pounding in your ears? These cases may be extreme, but your heart does work harder when you are running, swimming, or under stress. Your heart will beat more rapidly and with greater force, pumping more blood to your tissues in an effort to meet their increased demands for oxygen and nutrients.

Just how much does your heart rate increase with exercise? You should have an idea after completing this investigation.

Materials You Need

- watch or clock with a sweep second hand
- bench or box roughly 45 cm high

Steps to Follow

STEP A

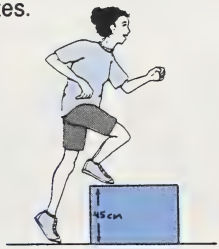
Sit down at a desk or table and take a 10 second pulse. Multiply this number by six and record this value as your initial heart rate.

Initial Heart Rate = _____

STEP B

Step up and down on the box or bench (about 45 cm high) for 2 minutes. Start with either leg (up); then bring up the other leg so that you have both feet on the box for a moment. Step down, one leg at a time, so that you have both feet on the ground for a moment. Try to establish a rhythm (up, up, down, down) to complete two full cycles every 5 seconds.

Exercise non-stop for a full 2 minutes.



STEP C

Take your pulse for 10 seconds immediately after completing the step test. Multiply this number by six and record this value as your working heart rate.

Working Heart Rate

= _____ beats/minute

STEP D

Remain sitting for 2 minutes and then take another 10 second pulse. Multiply this number by six and record this number as your recovery heart rate.

Recovery Heart Rate

= _____ beats/min

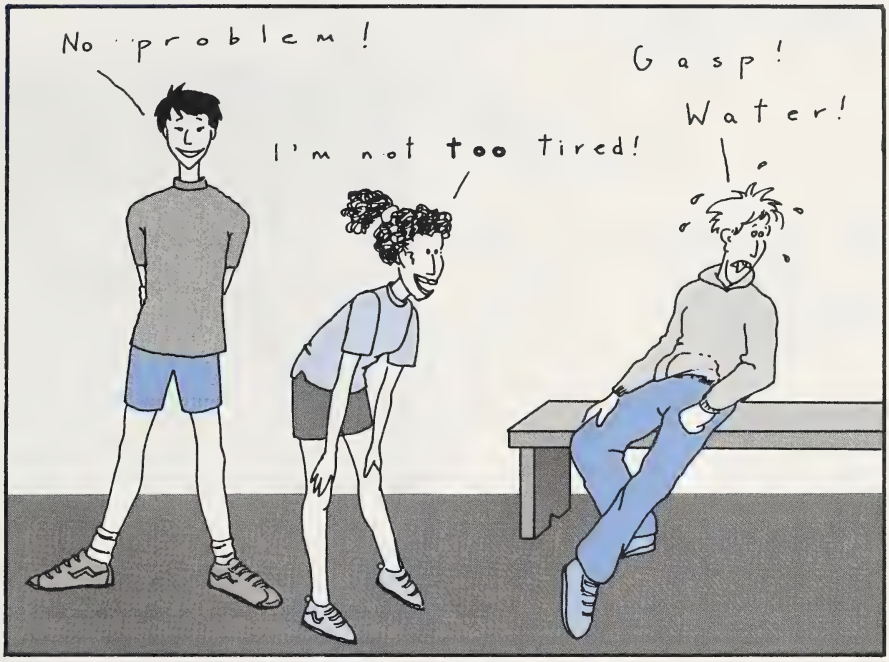
Conclusions

4. Compare your initial heart rate and your recovery heart rate. Is there a difference? Explain why or why not.

5. Did the step test cause any other changes in your body functions? Describe any changes you observed and try to explain why they occurred.

Check your answers by turning to the Appendix, Section 1: Activity 1.

After completing the step test, your working heart rate was probably somewhere between 90 and 190 beats per minute. Just how hard your heart had to work depends on how strenuously you exercised and your general fitness level.

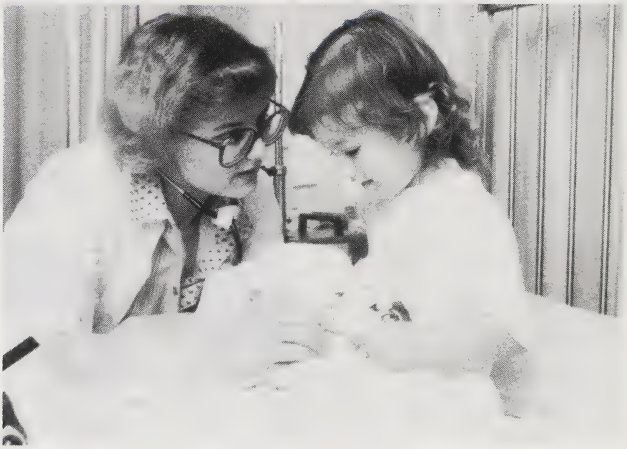


Your recovery heart rate also gives you some idea of your general level of fitness. The more often you exercise, the better your systems adapt to physical stress and the more quickly the systems will recover. People in good physical condition will have a recovery heart rate very close to their initial heart rate 2 minutes after completing the step test.

Did You Know?

Well-trained athletes have a resting heart rate of between 44 and 55 beats per minute. The resting heart rate of the average person is 72 beats per minute.

Activity 2: An Expert Opinion



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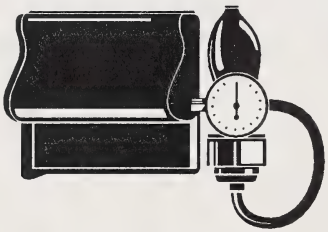
Have you visited a doctor in the past year? Have you ever had a complete physical check-up? To perform a physical examination your doctor makes use of a number of technological devices. These devices have been developed to provide physicians with the information needed to diagnose or detect medical problems. When performing a routine physical check-up, your doctor will probably make use of the following devices.

- otoscope
- tongue depressor
- stethoscope
- patella hammer
- sphygmomanometer

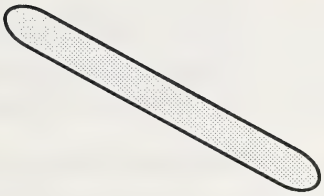
Can you recognize each of these devices?

1. Match the following by placing the letter of the name and description beside the appropriate diagram.

_____



a. Otoscope – used to examine the eardrum for signs of infection

_____ 

b. Stethoscope – used to listen to heart and lung sounds

_____

c. Patella hammer – used to test the reflex response of the nerves in the lower leg

_____

d. Tongue depressor – used to examine your tonsils and throat for signs of infection

_____

e. Sphygmomanometer – used to measure your blood pressure

Check your answers by turning to the Appendix, Section 1: Activity 2.

Your doctor will also take your pulse, using a technique similar to the one you used in the investigations in Activity 1. For more information regarding the general state of your heart and circulatory system your doctor will use the stethoscope and the sphygmomanometer.

The Stethoscope

The early physicians used to place one ear against their patient's chest in an attempt to hear the sounds of the heart and other organs. The sounds they heard were muffled and often distorted by outside interference.

2. Place your ear against the chest of another person. What do you hear?

_____

_____

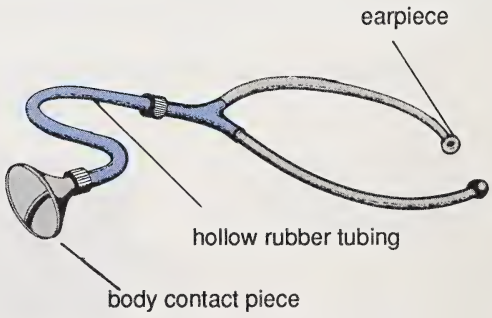
_____

_____

Physicians used this method until 1816, when Rene Laënnec, a French physician and surgeon, recognized the need for some type of device to improve the ability to hear heart and lung sounds. Laënnec used a hollow wooden tube to listen to a patient's heart and other organs. Laënnec invented a technological device which is still in use today, the stethoscope.

Modern Stethoscopes

Diaphragm



Bell Type

Laënnec's original stethoscope has been refined and redesigned to produce the modern stethoscope. The function, however, has remained the same. The physician places the body contact piece against the body of the patient and is able to hear the sounds made by the organs.

Sound is collected and amplified by the body contact piece and transferred through hollow rubber tubing to the earpieces of the stethoscope. When the earpieces are in a physician's ears they provide a "direct line" for sounds coming from a patient's body to the physician's ears. External noises are blocked out and prevented from interfering with the transmission of sound.

Investigation: Using the Stethoscope

Just what can you hear when using a stethoscope? Do you hear anything new or different? The stethoscope should give you more information regarding your heartbeat and the sounds produced by other internal organs.

Materials You Need

- stethoscope
- a partner

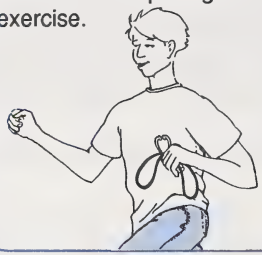
Steps to Follow

Caution: Never yell into a stethoscope. Loud noises can cause severe damage to the ears of the listener.

STEP A	OBSERVATION
Place the earpieces of the stethoscope into your ears; then place the body contact piece firmly against your chest, just slightly to the left of the centre.	3. Describe what you hear. _____ _____ _____ _____

STEP B

Run on the spot or up and down a set of stairs for 1 minute. Use your stethoscope to listen to your heart after completing the exercise.



OBSERVATION

4. Describe what you hear. Try to explain any differences in heart sounds.

_____

_____

_____

_____

_____

STEP C

Obtain a partner so that you can listen to air moving into and out of his or her lungs. Place the body contact piece on either the right or left side of the back, just below the shoulderblades. Listen as your partner breathes deeply several times.

OBSERVATION

5. Describe what you hear.

_____

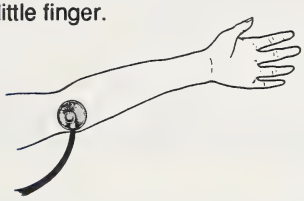
_____

_____

_____

STEP D

Use the stethoscope to listen to your pulse. Place the body contact piece on your wrist, the side of your neck, and the inside bend of the elbow on the side of your little finger.



OBSERVATION

6. Describe what you hear.

_____

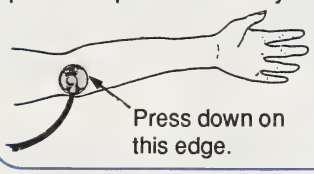
_____

_____

_____

STEP E

Sit down at a desk or table. Straighten your arm and place the body contact piece on the little finger side of the inside bend of your elbow. Press down on the lower edge of the contact piece to squeeze the artery.



OBSERVATION

7. Describe what you hear.

_____

_____

_____

_____

Conclusions

8. Briefly explain how a stethoscope works.

_____

_____

_____

_____

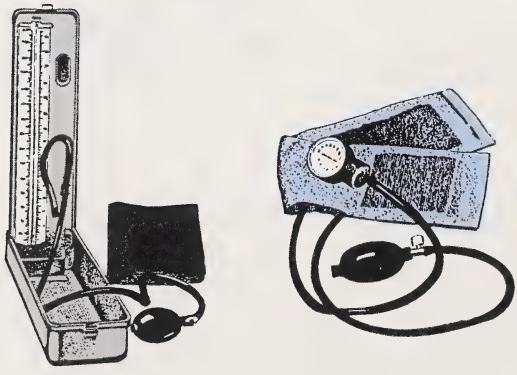
9. List three internal body sounds that you can hear when using a stethoscope.

- _____
- _____
- _____

Check your answers by turning to the Appendix, Section 1: Activity 2.

The Sphygmomanometer

Your doctor will also use another technological device during a physical check-up to determine the general fitness of your heart and circulatory system. A sphygmomanometer is used to measure the pressure that your blood exerts on the walls of your arteries.



Two Types of Sphygmomanometers

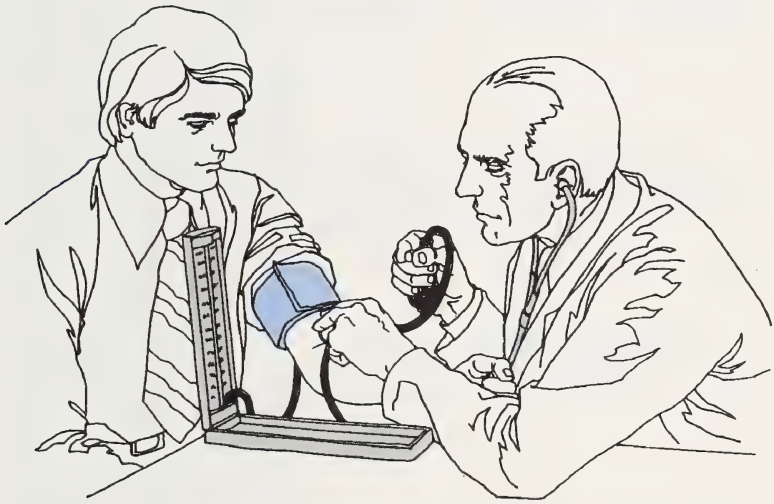
As the ventricles of your heart contract, blood is forced into the arteries and throughout the circulatory system. This blood exerts a great force or pressure against the walls of your arteries. Have you ever suffered a deep cut which damaged one of your arteries? Blood does not flow gently from such a cut; it spurts out, up to 1.5 m with each contraction of your heart.

Minor hockey players must all wear special neck guards to prevent a skate blade from accidentally cutting the carotid artery, the main artery carrying blood from the heart to the brain.

A person would not last for more than a few minutes with blood flowing from a severed carotid artery. The heart would pump all of his or her blood out through the cut.

You now know that the blood being pumped throughout your body is under tremendous pressure. What kind of diagnosis can a doctor make by knowing your blood pressure? Is there a standard or **optimal** pressure with which blood should be flowing through your arteries?

optimal - most satisfactory or desirable

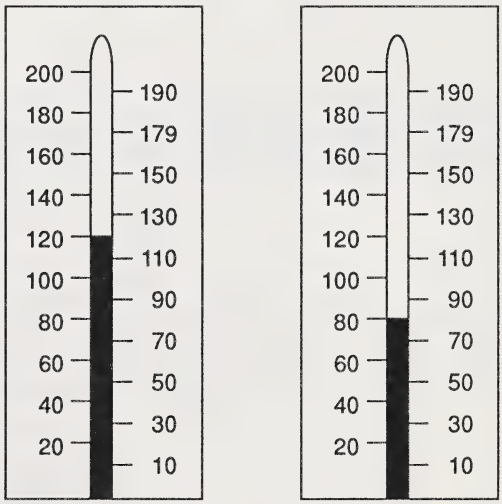


Measuring Blood Pressure Using a Sphygmomanometer and a Stethoscope

All types of sphygmomanometers measure blood pressure in millimetres of mercury. The readings from the sphygmomanometer indicate how high a column of mercury would rise if forced up by the pressure of your blood. Your body really has two blood pressure levels. This is because your blood pressure varies as your heart contracts and then relaxes. **Systolic pressure** is the highest blood pressure in your arteries, occurring when the ventricles of your heart contract. The ventricles also relax, filling with blood to prepare for the next contraction. This momentary rest period produces the lowest amount of pressure in your arteries, **diastolic pressure**. Your blood pressure is recorded as a fraction, with the systolic pressure written above the lower diastolic pressure.

$$\text{Blood Pressure} = \frac{\text{Systolic Pressure}}{\text{Diastolic Pressure}}$$

10. What would your blood pressure be if your doctor recorded the following readings from a mercury sphygmomanometer?



Blood Pressure = _____

The average normal blood pressure for individuals 15 to 18 years of age is

$$\frac{\text{110 to 120}}{\text{70 to 80}}.$$

11. Would a blood pressure reading of 140/90 be considered normal for an 18-year-old student? Explain why or why not.

Your blood pressure is not constant from day to day. The following chart explains some of the factors which influence your blood pressure level.

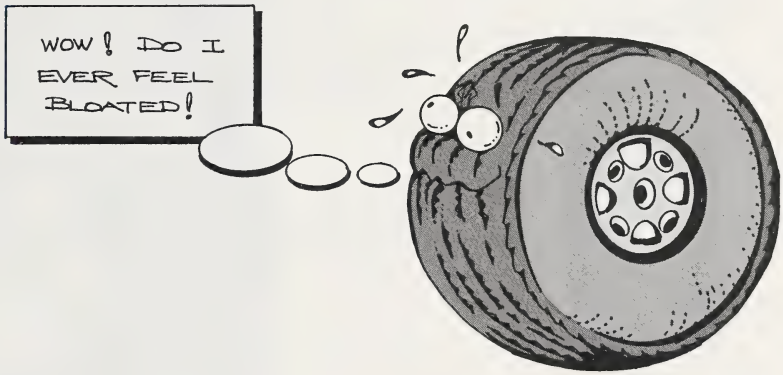
Factors	Effect on Blood Pressure
Heart Rate	The faster your heart beats the greater the blood pressure. A reduced heart rate lowers your blood pressure.
Amount of Blood	Loss of blood due to injury means a decreased volume of blood and a drop in blood pressure. Blood pressure increases with greater amounts of blood.
Diameter of Arteries	Narrowing or constricting the diameter of arteries increases the blood pressure. Blood pressure will drop when blood vessels expand.
Elasticity of Arteries	Arteries expand when blood is forced through them. This expansion lowers blood pressure. Blood pressure increases when arteries lose flexibility and the ability to expand.

12. The following chart lists a number of other factors which can influence your blood pressure. Try completing the chart by explaining how you think each factor would affect your blood pressure.

Factors	Effects on Blood Pressure
Age	
Body Mass	
Physical Activity	
Stress	
Smoking	

hypertension - a condition where your blood pressure remains high, even when you are at rest

A number of factors can combine to produce high blood pressure levels in an individual. High blood pressure (also known as **hypertension**) places extra stress and strain on your heart, arteries, kidneys, and other organs. Have you ever overinflated a car or bicycle tire?



Excessive air pressure causes the surface of the tire to stretch or bulge, leading to excessive wear on certain parts of the tread. This reduces the useful life of the tire, since it wears out more quickly than normal. Hypertension or high blood pressure has a similar effect on your circulatory system. It is particularly damaging to the small blood vessels in your heart, brain, kidneys, and eyes. If untreated, hypertension will shorten your life. Unfortunately, it is a disease with no symptoms. You cannot see or feel the damage being done by high blood pressure until some organ or vessel ruptures or breaks down. Heart attacks, strokes, and kidney failure are often caused by years of high blood pressure. Regular blood pressure checks are important for the detection of hypertension.

13. Bill Waters is about 20 kg overweight, smokes two packs of cigarettes per day, and is under a lot of stress at work. Give three reasons why Bill probably has high blood pressure.

_____

_____

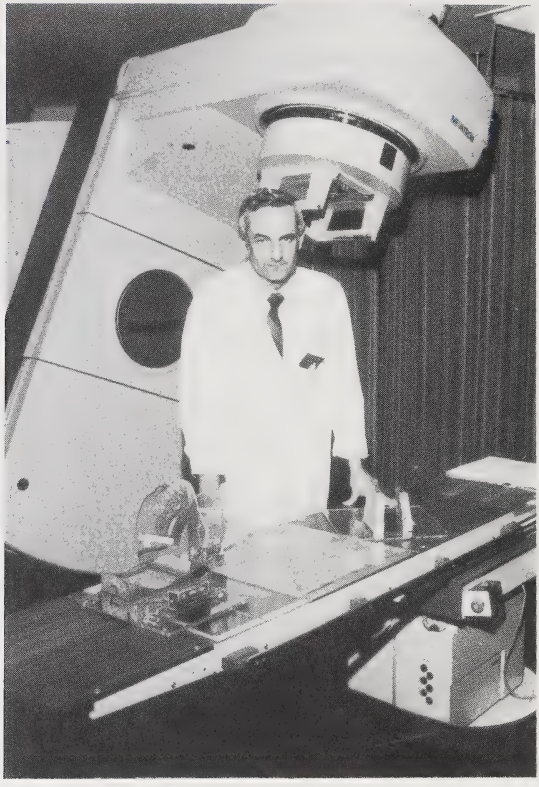
_____

_____

_____

Check your answers by turning to the Appendix, Section 1: Activity 2.

Activity 3: Technology and You



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The stethoscope and sphygmomanometer are not the only diagnostic tools which can be used by your doctor. Modern technology has created a number of **diagnostic tests** and devices to monitor and evaluate the fitness of body systems. **Sonography** and x-rays are two diagnostic tests which allow the physician to examine internal structures without having to resort to surgery. Doctors are able to obtain essential information regarding the fitness or general operation of an internal structure without the **trauma** and expense of surgery. Sonography is a painless, harmless, imaging technique which uses high-frequency sound waves (ultrasound) to create images of structures within your body. Perhaps the best known and most common usage for ultrasound is in the examination of the developing child in pregnant women. Do you know of any other diagnostic tests?

diagnostic test - an activity that is done to identify or prevent injury or illness

sonography - an imaging technique which uses high-frequency sound waves to create images of structures within the body

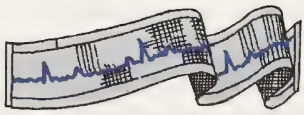
trauma - the injury or damage to body tissues caused by an outside force or foreign object

1. Match the diagnostic test with the body system that it tests. Write the letter of the diagnostic test in the space provided in front of the appropriate body system.

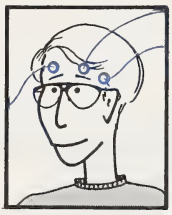
_____	Muscular system	_____	Digestive system
_____	Nervous system	_____	Skeletal system
_____	Circulatory system	_____	Hormonal system

a. **x-ray** – an imaging technique used to locate breaks in your internal framework

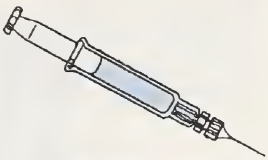
b. **electrocardiogram (ECG or EKG)** – a reading of heart activity



c. **electroencephalogram (EEG)** – a tracing of the electrical activity in the brain

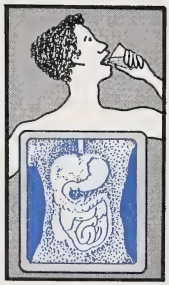


d. **blood tests** – a test that can be used to isolate specific chemicals to check for imbalances



e. **dynamometer** – a spring-loaded machine that measures strength

f. **barium fluoroscope** – an imaging technique that shows the movement of a barium "milkshake" on a screen

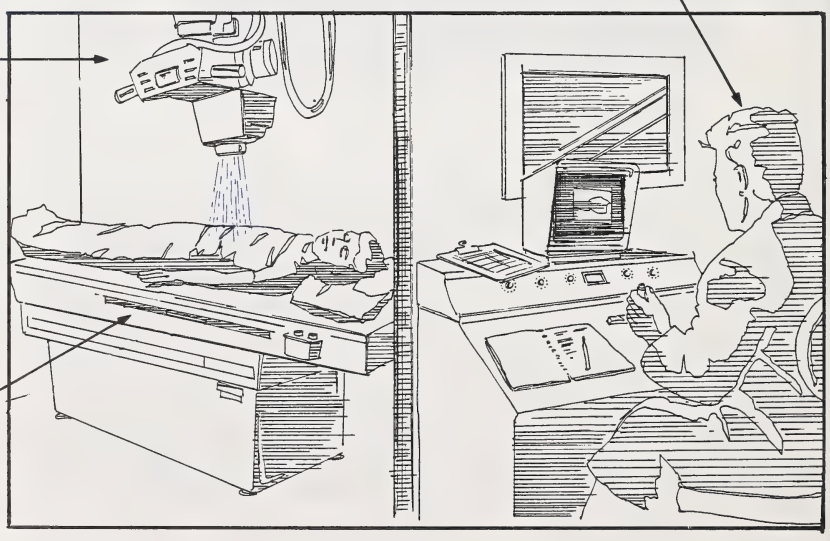


Check your answers by turning to the Appendix, Section 1: Activity 3.

One of the most widely used diagnostic tests is the x-ray. X-rays are high energy electromagnetic waves which are able to pass through the soft tissues of the body. Wilhelm Konrad Röntgen, a German physicist, was the first to recognize the diagnostic potential of x-rays. In 1895 Röntgen produced the first x-ray photograph – a picture of his wife's left hand which distinctly showed her bones and wedding ring. Doctors immediately saw the usefulness of Röntgen's discovery and within months were using x-rays to diagnose patients' **fractures**. Do you know how an x-ray is produced?

fracture - any damage to the skeletal system
This includes breaks, cracks, chips, and the splintering of bone.

The X-ray Process


Lead wall for technician's protection
X-ray technician
X-ray machine - produces x-rays that pass through flesh and darken photographic film
• X-rays do not pass through bone, thus leaving white images on the photographic film.
Photographic film - turns black when exposed to x-rays

The exposed film is developed in a special machine to produce the finished x-ray.

xeroradiography - the production of x-ray pictures on plastic using a process similar to that used by photocopy machines

Most x-ray pictures taken today are recorded on sheets of clear plastic rather than photographic film. This process, known as **xeroradiography**, is cheaper and requires less x-ray exposure to produce a clear image.

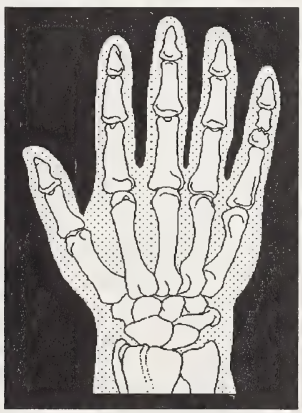
How much information can you obtain from an x-ray? Complete the questions using the x-ray in the margin.

2. How many bones are found in the palm of your hand?

3. How many bones make up your entire hand?

4. Explain the difference in structure between your thumb and the other four fingers.

Now that you are familiar with the bone structure of the hand, try to make your own diagnosis for the following x-ray.



5. Count the number of bones in the hand. Has this number changed?

_____

_____

_____

6. Are there any differences between this x-ray and the first x-ray that you looked at? Explain your answer.

_____

_____

_____

Check your answers by turning to the Appendix, Section 1: Activity 3.

The steps you have followed are the basis for a diagnosis. When making a diagnosis you must first examine a correct or normal x-ray and then use this knowledge when looking at an x-ray to be diagnosed.

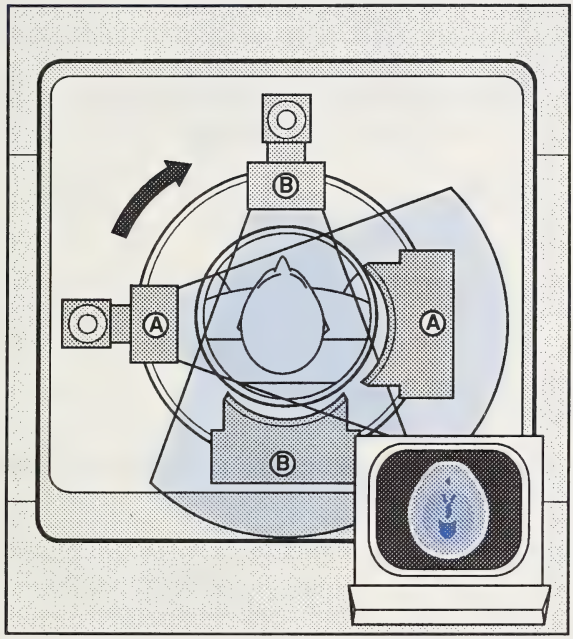
Today's doctors have access to an ever-increasing number of diagnostic tools. Medical technology has blossomed with the development of computers, lasers, fiber optics, supercooled magnets, and radioisotopes. These scientific advancements have led to the developments of

- Computerized Axial Tomography Scanners (CAT Scanners)
- Magnetic Resonance Imaging (MRI)
- Digital Subtraction Angiography (DSA)
- Positron Emission Tomography (PET)
- Sonography (Ultrasound)
- Balloon Angioplasty
- Laser Surgery

These technologies have vastly improved the diagnosis and treatment of disease.

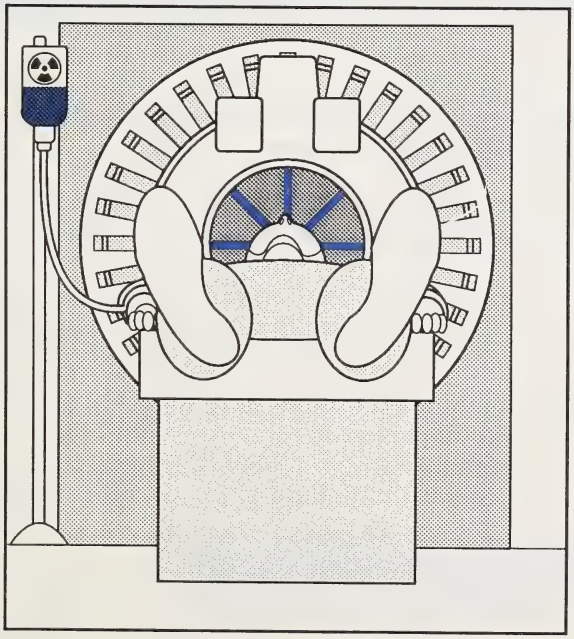
Take a closer look at two of these technologies.

CAT Scanner



CAT Scanners use a rotating x-ray tube to produce detailed cross sectional images of soft tissues. The x-ray images are converted into digital computer code to produce high resolution video images which can be stored on magnetic computer disks. A CAT scan produces detailed images of the brain, the lungs, the heart, or other soft tissues. It is most useful for illustrating small differences between normal tissues and abnormal tissues such as brain tumors.

PET Scanner



The Positron Emission Tomography scanner uses radioactive sugar molecules to monitor cellular activity within the brain, the heart, the lungs, or the liver. Radioactive sugar molecules are introduced into the patient's circulatory system through an intravenous drip. The PET scanner is able to produce images by detecting radioactive energy as it leaves the body of the patient. The images produced by the PET scanner allow doctors to observe normal cell activity and to pinpoint areas of abnormal activity. The PET scanner can be used for detecting Alzheimer's disease, epilepsy, schizophrenia, Parkinson's disease, and the damage caused by a stroke.

The modern technology of the CAT and PET scanners comes with a high pricetag. Each individual machine costs well over one million dollars. Despite the cost, there is still a high demand for CAT and PET scanners all across Canada to provide society with the best possible medical care.

7. Which type of scanning machine would you use to examine blood flow in the muscle tissue of the heart – CAT or PET? Explain your answer.

_____

_____

_____

_____

_____

8. Which type of scanning machine uses radioactive material to detect abnormal activity within the body?

_____

_____

Check your answers by turning to the Appendix, Section 1: Activity 3.

The use of the CAT and PET scanners is a quick and painless way to examine essential structures within the body.

Remember that society has developed some type of medical technology to examine or diagnosis every system within your body.

Follow-up Activities

If you had difficulties understanding the concepts in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts, it is recommended that you do the Enrichment.

Extra Help

1. Place a **T** in front of the statements that are true and an **F** in front of the statements that are false.

_____ a. Wilhelm Röntgen invented the scanning electron microscope.

_____ b. As society's technology increases, so does the understanding of the human body.

_____ c. A diagnostic test is done to identify or locate disease.

_____ d. An EKG is done to see if your hormonal system is working properly.

_____ e. An x-ray is used to locate fractures in your skeletal system.

_____ f. An EEG is a diagnostic test used to monitor your nervous system.

_____ g. A dynamometer is a machine used to test blood flow within the heart.

_____ h. Pulse rates can be used as an indicator of your general health.

_____ i. A low pulse rate is generally an indicator of good health.

_____ j. Hypertension is a painful disorder which causes severe headaches.

_____ k. The sphygmomanometer is used to listen to heart and lung sounds.

Check your answers by turning to the Appendix, Section 1: Extra Help.

Enrichment

1. Make an appointment with your family doctor for a complete physical check-up. Be sure to ask for your blood pressure reading and an analysis of your general state of health. You may also wish to ask your doctor how hypertension is controlled. Are special diets or drugs required to control blood pressure?

2. Complete a survey of your family or community regarding the frequency of hypertension. How many people actually know what their blood pressure reading would be?

3. Use your local library or hospital to research modern medical technology. You may wish to learn more about one or more of the following:

    - the Electrocardiogram
    - the Electroencephalogram
    - Magnetic Resonance Imaging (MRI)
    - Digital Subtraction Angiography (DSA)
    - Sonography

    Are any of these technologies being used in your community?

Share your answers with your learning facilitator.

Conclusion

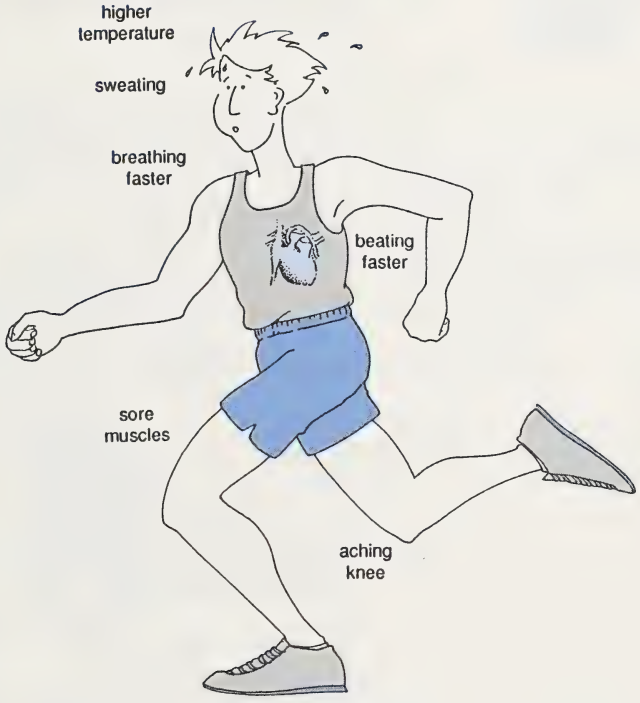
Technology is a great help to doctors in their efforts to cure all that ails the people of the world. Diagnostic testing equipment, such as the computerized axial tomography scanner, have enabled surgeons to locate and remove brain tumors that would have previously been considered inoperable and fatal. Modern technology saves lives and has contributed to the high level of health care that you enjoy.

Assignment Booklet

ASSIGNMENT

Turn to your Assignment Booklet and do the assignment for Section 1.

2 Your Body in Flux



How does your body function when you walk? What changes when you jog? What happens when you start to work really hard? Your body is a meshing of many systems that work together to keep you alive and well.

In this section you will study what happens when you begin to place stress on one body system. You will also look at what your other body systems do to compensate for these stresses. Is there a point where these stresses become too great for your body? It's important to know your limits and to know how outside influences affect specific body systems. Too much stress can lead to injuries or a general shutdown of entire body systems. In this section you will examine some ways of identifying and treating broken bones and heart attack. You will also look at the technology required to treat injuries and sustain life when body systems fail.

Activity 1: Your Body as a Whole

Whenever you walk or run, your body systems change and adapt to the stresses that you are placing on your body. A change within one system will cause changes in all the other systems of your body. The next investigation will allow you to see how your body adapts to physical exercise.

Investigation: Are You Sweating?

It is easy to see that running or skipping on the spot places stress on your muscular system.

Your muscles must work to make you move. In this investigation you will look at how running affects other body systems and how these systems help your muscles cope with the stress of exercise.

Materials You Need

- watch or clock with a sweep second hand
- skipping rope (optional)

Steps to Follow

STEP A

Start by exercising for 5 minutes. You can spend 5 minutes jogging, running on the spot, or skipping rope.

STEP B	OBSERVATION
Take your pulse for 10 seconds immediately after exercising. Remember to multiply this number by six to obtain your working heart rate.	10 second pulse = _____ × 6 Working heart rate = _____

STEP C	OBSERVATION
Exercise by skipping, running on the spot, or jogging for another 5 minutes. Complete the observations immediately after exercising. 	Count the number of times you exhale (breathe out) in 1 minute. Record this value as your breathing rate. _____ breaths per minute Next, feel your armpit. Does it feel warmer than usual? _____ Yes _____ No Are you sweating? _____ Yes _____ No

STEP D	OBSERVATION
Relax for 5 minutes. Then determine your breathing rate when at rest. Again, count the number of times you exhale in 1 minute.	Resting Breath Rate = _____ breaths/minute

Conclusions

1. Compare your resting breathing rate with your breathing rate immediately after exercising. Is there a difference? Explain why or why not.

2. Briefly explain why you sweat after a period of vigorous exercise.

3. What could happen when you push your body too far, trying to go beyond your normal limits of endurance?

Check your answers by turning to the Appendix, Section 2: Activity 1.

When you exercise, your body produces not only the energy to move but also quite a bit of heat energy. If all this heat remains inside, you would probably burn up! Your circulatory system moves excess heat to the surface of your skin. That's why your armpits and the rest of your body feel warm. Heat will pass through the skin and out into the air. This does not cool your body down too rapidly; that's why you sweat. Sweat evaporates off your skin surface and takes excess body heat with it. All of your body systems work together to compensate for any normal stress that you place upon it.

Activity 2: Emergency

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Have you ever suffered a bad sprain or broken a bone? It's often hard to tell exactly how bad your injury might be, with all the pain, swelling, and bruising. A wrist that feels broken may just be sprained or bruised. Your doctor will request an x-ray of the injured area anytime there is even a suspicion of a broken bone. There are some simple steps that everyone can use to diagnose an injury. These steps will help you determine whether or not an injury requires an ice pack or further medical attention.

Is a Bone Broken?

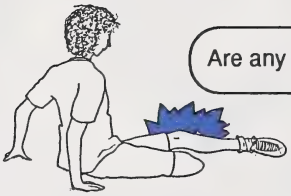
You have just found a person lying on the ground after what looks like a bad fall.

Check to see if

- any limbs are cold or bluish in colour
- the person has extreme pain in pelvis or thigh
- the person is pale, sweaty, thirsty, or dizzy

YES → Get Medical Help Now.

NO



Are any of the limbs crooked or fractured?

YES → Get Medical Help Now.

NO

Is any limb unusable or unable to bear weight?

YES → Get Medical Help Now.

NO

Is there extensive bleeding or bruising? Did the injury occur because of a severe blow?

YES → Get Medical Help Now.

NO

Apply Some Home Care.

Home care for any bone injury or sprain is commonly called RICE. This stands for **R**est, **I**ce, **C**ompression, and **E**levation. The following steps will help reduce swelling, ease pain, and speed up recovery.

Rest – Stay off or do not use an injured limb for at least a week.

Ice – Apply an ice pack to the injured area for 20 minutes right after an injury, and repeat every 2 hours thereafter for at least a day.

Compression – Wrap the injured limb with a tensor bandage to reduce swelling and restrict movement.

Elevation – Keep the injured limb raised using a pillow. This allows fluid to drain from the injured area and should reduce swelling.

If pain persists after one week of RICE, the injury should be examined by a doctor. There is no real substitute for a physician's care.

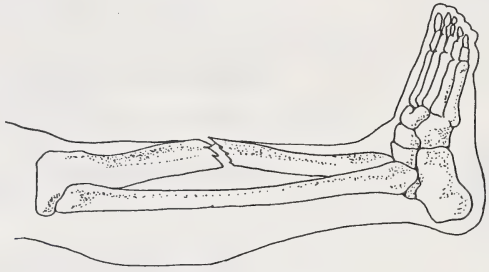
1. What steps should be taken if you suspect a person of having a broken bone?

2. Describe the home care treatment known as RICE.

compound fracture - any break in which the bone is exposed to the outside air

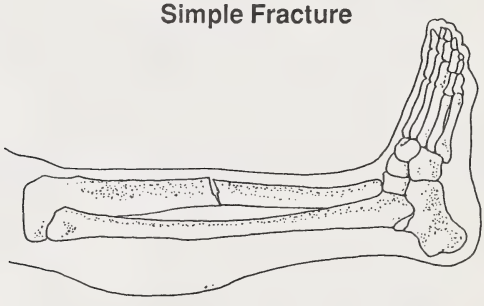
Your doctor will refer to any type of bone damage as a fracture. This means that fractures are not only complete breaks, but they also include chipped, cracked, and splintered bones. The most serious type of fracture is known as the **compound fracture**. Bones break through the skin or are exposed by deep cuts or wounds.

Compound Fracture

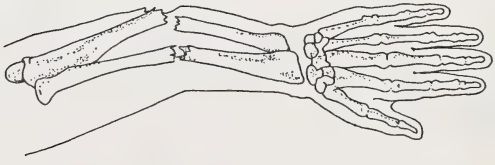


Simple fractures do not penetrate or "stick out" through the surface of the skin. Simple fractures usually include chipped, cracked, and some broken bones.

Simple Fracture

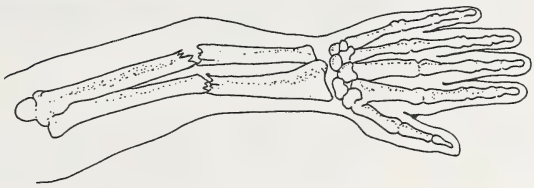


3. What type of fracture is shown in this diagram? Explain your answer.

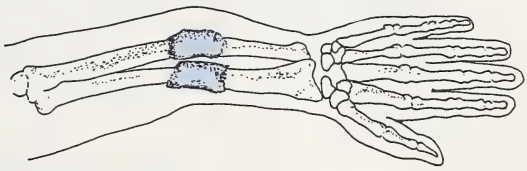


It is important that fractures receive immediate medical attention. This is because of the way bones heal. Bone cells around the fracture will divide rapidly to form a mass of new tissue. This mass grows over the fracture and will produce the new bone required to repair the injury.

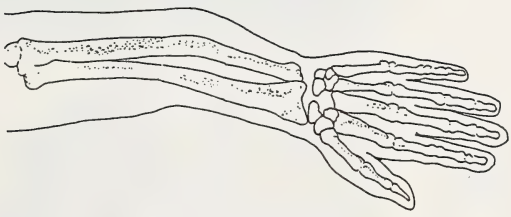
Fracture



Mass of new tissue



Healed bone



4. Has the fracture shown in the diagrams healed properly? Explain why or why not.

_____

_____

_____

_____

A fracture should be immobilized immediately to prevent further damage to muscles, nerves, and blood vessels surrounding the bone. X-rays must be taken of all fractures to determine the extent of the injury and to check the alignment of bones. Broken bones must be straightened or set as soon as possible by qualified medical personnel.

Surgery using pins, plates, and screws may be needed to repair and realign serious fractures. Once a bone fracture has been repaired and realigned, it must be immobilized to permit proper healing. The most common method of immobilizing a fracture involves the use of a plaster cast. The cast restricts movement, maintains the proper alignment, and prevents any further injury to the fracture. The cast may have to remain on for weeks or months depending on the bone which has been fractured, the type of fracture, and the age and health of the patient.

5. Ben Hurry had broken his forearm four weeks ago. The bones had been realigned and a plaster cast had been applied to the fracture. The cast peeled off about a week later while Ben was in the shower. Now his arm aches all the time and it appears to be a bit crooked. What must be done to help Ben?

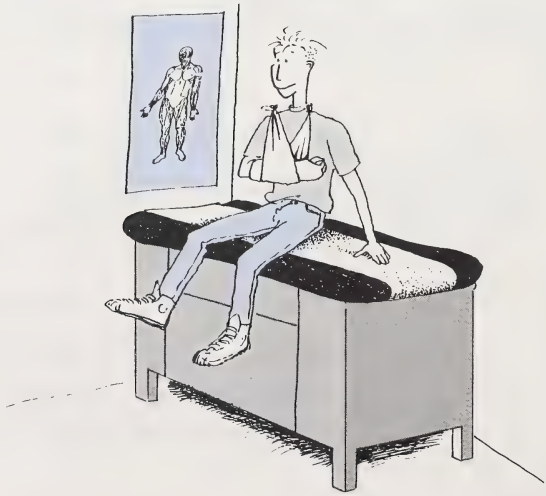
_____

_____

_____

Check your answers by turning to the Appendix, Section 2: Activity 2.

The stresses resulting from broken bones affect not only the skeletal system but all other body systems as well. Muscles in the area refuse to work, nerves are only concerned with pain, and your heart rate and breathing increase because of the injury. Your body systems alert you of damage and immediately begin repairs. Medical technology helps to speed up your recovery to a healthy state.



Activity 3: Heart Attacks and You

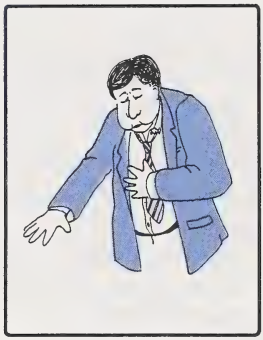
Have you ever felt a heavy, squeezing pain in the centre of your chest? Did the pain ever spread to your shoulders, arms, or back? Were you suddenly short of breath, sweating, or sick to your stomach? This may have been a bad case of indigestion or you may have just suffered a heart attack. Approximately 50 000 Canadians die each year after experiencing symptoms similar to these. Heart attack is the leading cause of death in Canada. Medical technology has a number of life-saving instruments which can be used in the treatment of heart attack. The problem is that over half of all heart attack victims die within a few hours of the attack, before they are able to receive any medical assistance.

You may be able to save a life by recognizing the symptoms of a heart attack. The heart attack victim should be taken to a hospital immediately so that trained personnel can begin treatment. If you cannot drive, call for an ambulance immediately. Never let heart attack victims drive themselves to the hospital.

The following symptoms signal a heart attack:

- a heavy, squeezing pain in the center of the chest which can last for several minutes

- pain spreading to the neck, jaw, shoulders, arms, or back from the centre of your chest



- sweating, vomiting, shortness of breath, dizziness, or weakness

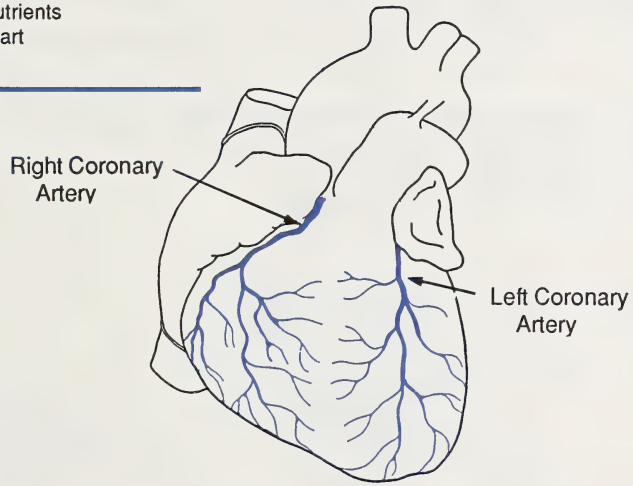
- denying being ill even though it is obvious that there is great pain

These symptoms often come and go. The victim may have chest pain for a few minutes and then feel better. This does not mean that the heart attack is gone. The victim must be taken to a hospital immediately and be examined by a physician.

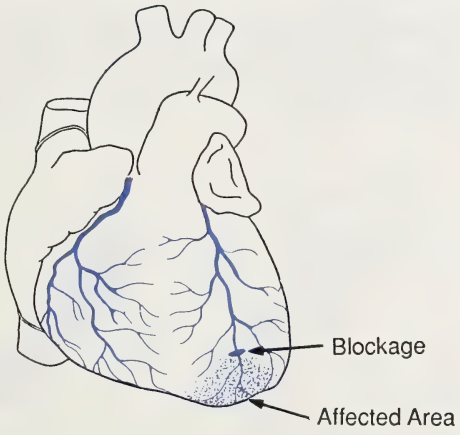
1. Wayne Wringer, age 48, just completed a 4 km jog. He feels tired, sweaty, and complains of some pain in his chest and shoulders. He looks pale but says he will feel better after a 5 minute rest. Would you take Wayne to the hospital? Explain why or why not.

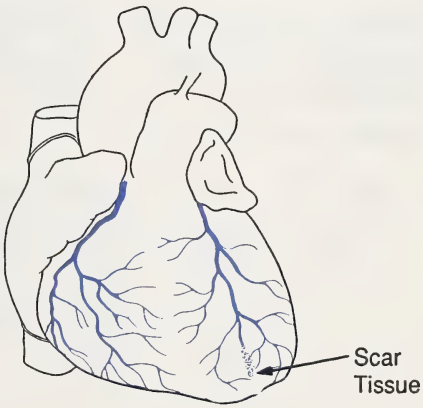
What Causes a Heart Attack?

coronary arteries - the two arteries which provide oxygen and nutrients to all of the heart muscle cells



Your heart depends on a constant supply of blood to function properly. Two arteries, the left and right coronary arteries, branch out to provide all of the heart muscle cells with oxygen and nutrients. A heart attack occurs when one of these arteries becomes blocked. A complete blockage in any branch of a coronary artery will cut off the blood supply to that portion of the heart. The muscle cells in the affected area of the heart stop working and die. Heart muscle damaged because of a small heart attack is replaced with scar tissue and nourished by extensions from other blood vessels.

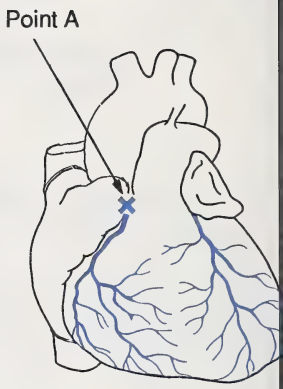




Many people die suddenly because of massive heart attacks, the result of blockages which affect a large region of the heart.

2. Does the heart obtain oxygen and nutrients from the blood it pumps throughout the body? Explain why or why not.

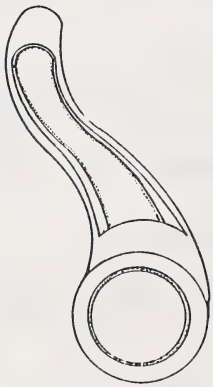
3. A person with the heart shown on the right suffered a complete blockage at Point A. Would this blockage prove fatal to the person? Explain why or why not.



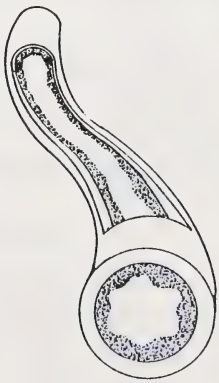
Atherosclerosis: The Clogging of Arteries

atherosclerosis - the buildup of fatty substances known as plaque on the inside of arteries

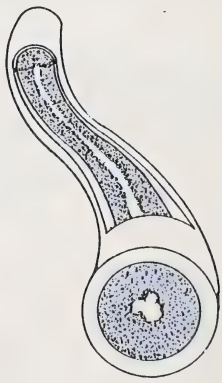
In most cases heart attacks are the final stage of a disease known as atherosclerosis. Fatty substances build up on the inside walls of arteries. This buildup reduces the diameter of arteries and restricts the flow of blood.



Normal artery



Narrowing of arteries due to plaque buildup



Clogged artery restricting the flow of blood

angina - recurrent chest pain due to a reduced blood supply to part of the heart

stroke - death of brain cells as a result of blockage or rupture of blood vessels

Atherosclerosis can lead to hypertension (high blood pressure), angina, stroke, heart attack, or poor circulation.

The rough walls of arteries affected by atherosclerosis provide a place for blood clots to form. These blood clots may be large enough to close off an artery in the heart or brain, causing a heart attack or stroke.

4. What is the difference between a heart attack and a stroke?

_____

_____

_____

_____

The following factors influence the development of atherosclerosis and heart attack:

cholesterol - a fat-like substance which is the main component of plaque in the arteries

- cigarette smoking
- high blood pressure
- high cholesterol level
- heredity
- gender
- diet
- weight
- stress
- lack of exercise
- age

5. You can reduce the risk of heart attack by controlling most factors which contribute to atherosclerosis. There are, however, three factors over which you have no control. List the uncontrollable risk factors.

_____

_____

_____

Check your answers by turning to the Appendix, Section 2: Activity 3.

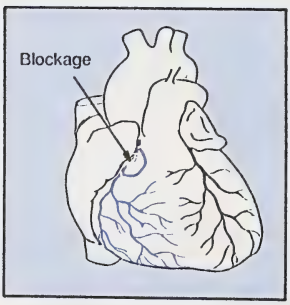
Fortunately, modern medical science has developed methods and technology to repair some of the damage caused by atherosclerosis and heart attack.

6. Match the diagrams with the descriptions of each life-saving technique or device.

catheter - thin tubing which is inserted into vessels or passageways to insert or withdraw fluids or to unblock vessels

_____

_____



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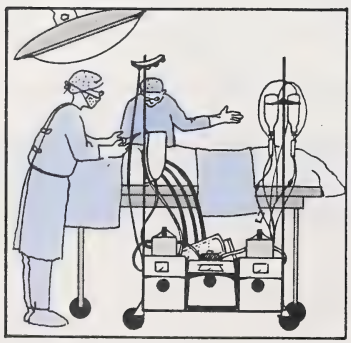


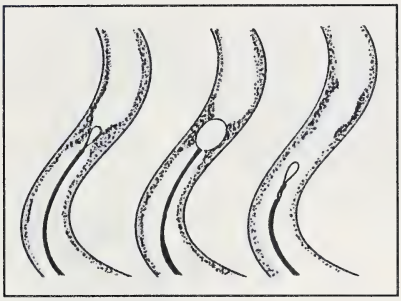
a. Coronary Bypass – A new vein is used to go around a blockage.

b. Balloon Angioplasty – A catheter with a balloon on the end is threaded through a vein to the heart. The balloon is inflated to compress the plaque against the artery wall, widening the opening for blood flow.

c. Laser Surgery – A microlaser contained in a catheter is inserted in a vein and moved to the blockage. The laser burns away the blockage.

d. Heart/Lung Machine – a machine which can take over heart and lung functions for a short period of time

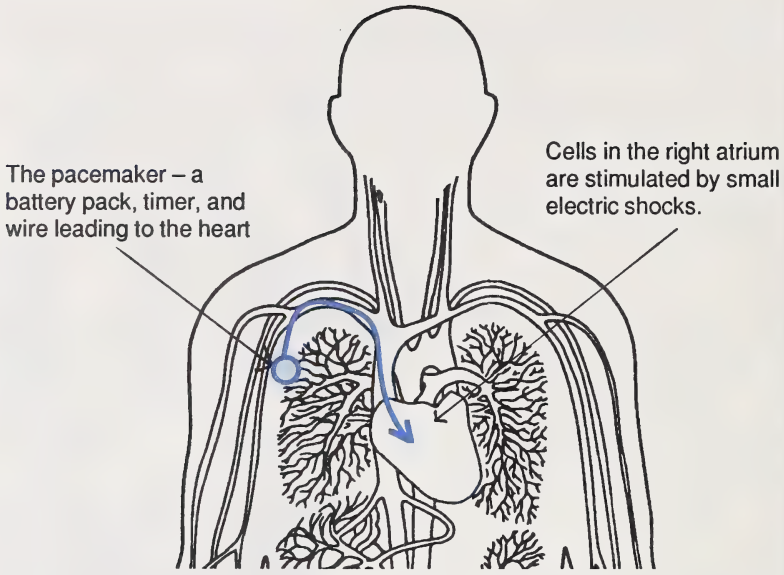
e. Drugs – chemicals introduced into your system to dissolve the blockage



Check your answers by turning to the Appendix, Section 2: Activity 3.

Do you know what causes your heart to beat regularly? Heart muscle is actually able to contract on its own, not needing to be stimulated by the nervous system. The contraction of heart muscle cells is coordinated by a specialized group of cells in the right atrium known as the pacemaker. The muscle cells of the pacemaker cause the atria to contract, forcing blood into the ventricles. The wave of contraction then passes through another specialized group of cells to the ventricles, causing them to contract. The ventricles contract about a tenth of a second after the atria. Damage to the cells of the pacemaker throws off the timing of the heart's contractions resulting in an irregular heart beat. Fortunately, medical science has developed an **artificial pacemaker**. This device sends a small electric shock to the heart at regular intervals. These small electric shocks maintain a regular heartbeat. The pacemaker is implanted under the skin on the right side of the chest and has a wire which follows a vein into the right atrium.

rtificial pacemaker -a device nplanted into the body to maintain regular heartbeat using small lectric shocks


The pacemaker – a battery pack, timer, and wire leading to the heart
Cells in the right atrium are stimulated by small electric shocks.

7. Would all heart attack victims require an artificial pacemaker to continue living a normal life? Explain why or why not.

_____

_____

_____

_____

Check your answers by turning to the Appendix, Section 2: Activity 3.

The quality of health care in today's society is possible only because of technology. Modern medical devices, such as the artificial pacemaker, give people a second chance at living a long and enjoyable life.

Follow-up Activities

If you had difficulty understanding the concepts in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts, it is recommended that you do the Enrichment.

Extra Help

Use the following list of words to complete the crossword puzzle that follows.

Word List

neck
heart attack
deny
laser surgery
x-ray
pale
rest
pulse rate
respiratory rate
stress
higher
compression
bruising

Down Clues

1. any exercise or outside pressure placed on the body

2. the rate at which a person breathes

3. An individual with a broken bone is usually sweaty, thirsty, dizzy, or _____.

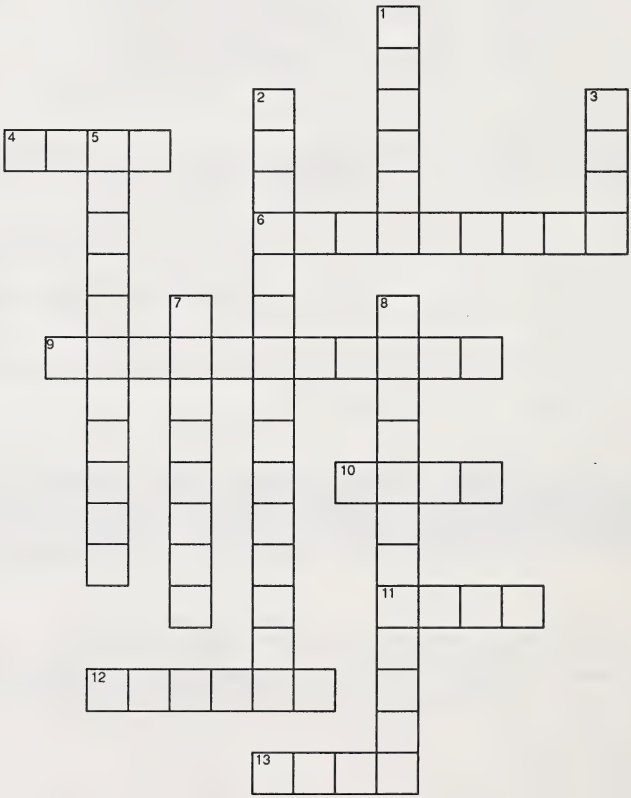
5. The C in the RICE formula stands for _____.

7. The area around a broken bone is often blue and purple because of _____.

8. removing a heart blockage by burning it with light

Across Clues

4. Pain from a heart attack can spread to this area.
6. the number of expansions in your arteries in 1 minute
9. caused by a blockage of a coronary artery
10. required by a doctor when checking for a broken bone
11. The R in the RICE formula stands for _____.
12. what happens to your pulse and respiratory rate when you exercise
13. what heart attack victims often do when having the attack



Check your answers by turning to the Appendix, Section 2: Extra Help.

Enrichment

Complete any of the following activities.

1. Obtain a first aid kit and manual. Spend some time learning how to treat and prevent simple injuries.

2. How can you reduce the risk of atherosclerosis and heart attack? Use your local library and pamphlets available from your public health unit to write a short report on ways to minimize the risks of heart disease.

3. Life-saving operations such as heart-valve replacement and heart transplants depend on certain drugs for their success. Use the local library to find out more about anticoagulants and immunosuppressive drugs.

Share your answers with your learning facilitator.

Conclusion

Your body is an intricate machine that works hard to keep you alive. Every organ or structure within your body depends on other organs and structures to function properly. Damage to one system or structure must be compensated for and repaired by all other systems. This healing process allows the body to recover from disease, stress, and damage by replacing, mending, and repairing tissues. Extensive damage to vital organs may now be treated with new medical procedures and advanced technology.

The advancements in medical science have led to improvements in health care, thus producing a healthier, longer-living society.

Assignment Booklet

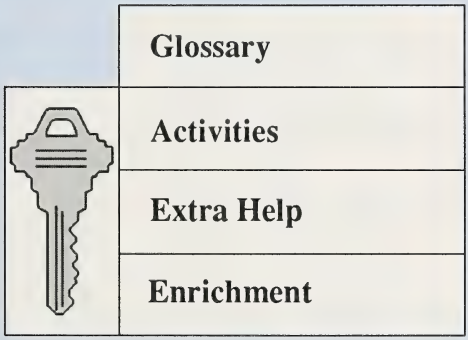
ASSIGNMENT

Turn to your Assignment Booklet and do the assignment for Section 2.

MODULE SUMMARY

Modern medicine relies heavily on science and technology for assistance in the diagnosis and treatment of disease. Simple devices such as the stethoscope and sphygmomanometer are routinely used to monitor heart rate and blood pressure. High tech devices such as CAT and PET scanners pinpoint the location of tumors within the body. Laser surgery and balloon angioplasty restore blood flow in the essential arteries feeding the heart. Whether they are simple or complex, these devices and techniques are all part of technology for life.

Appendix



Glossary

Angina	• recurrent chest pain due to a reduced blood supply to part of the heart
Artificial pacemaker	• a device implanted into the body to maintain a regular heartbeat using small electric shocks
Atherosclerosis	• the buildup of fatty substances known as plaque on the inside of arteries
Balloon angioplasty	• the use of a balloon on the end of a catheter to improve blood flow in arteries
Barium fluoroscope	• a diagnostic technique which uses x-rays and a barium solution to examine the digestive system
Catheter	• thin tubing which is inserted into vessels or passageways to insert or withdraw fluids or to unblock vessels
Cholesterol	• a fat-like substance which is the main component of plaque in the arteries
Compound fracture	• any break in which the bone is exposed to the outside air
Computerized axial tomography (CAT) scanner	• a device which uses x-rays to produce detailed images of soft tissues such as the brain, heart, and lungs
Coronary arteries	• the two arteries which provide oxygen and nutrients to all of the heart muscle cells
Coronary bypass	• a surgical process which uses a section of vein to bypass a blockage in a coronary artery
Diagnosis	• the educated opinion of a doctor to explain what is wrong in your body
Diagnostic test	• an activity that is done to identify or prevent injury or illness
Diastolic pressure	• the blood pressure in the arteries when the ventricles of the heart relax
Dynamometer	• a spring-loaded machine that measures muscle strength
Electrocardiogram (ECG or EKG)	• an electronic reading of heart activity

Electroencephalogram (EEG)	• a tracing of the electrical activity in the brain
Fracture	• any damage to the skeletal system This includes breaks, cracks, chips, and the splintering of bone.
Heart/lung machine	• a machine which can take over the functions of the heart and lungs for a short period of time
Hypertension	• a condition where your blood pressure remains high, even when you are at rest
Laser surgery	• the use of a microlaser contained in a catheter to burn away a blockage and improve blood flow
Magnetic resonance imaging (MRI)	• a device which uses a powerful magnetic field and radio signals to examine soft tissues which are encased in bone It is particularly useful for detecting cancerous tumors or tiny lesions from multiple sclerosis in the brain and spinal cord.
Optimal	• most satisfactory or desirable
Positron emission tomography (PET) scanner	• a device which detects the radiation released by radioactive tracers which are introduced into the patient's bloodstream The PET scanner uses the radiation to construct images of the cellular activity in body tissues such as the brain, lungs, heart, and liver.
Pulse	• the surge of blood in the arteries when the ventricles of the heart contract
Sonography	• an imaging technique which uses high-frequency sound waves to create images of structures within the body
Stroke	• the death of brain cells as a result of the blockage or rupture of blood vessels
Systolic pressure	• the blood pressure in the arteries when the ventricles of your heart contract
Trauma	• the injury or damage to body tissues caused by an outside force or foreign object
X-rays	• high-energy electromagnetic waves which are able to pass through the soft tissues of the body
Xeroradiography	• the production of x-ray pictures on plastic using a process similar to that used by photocopy machines

Suggested Answers

Section 1: Activity 1

1. Performing six trials should give you a more accurate resting heart rate. A single trial may give you an inaccurate reading, either higher or lower than normal.

2. Generally, the better your general fitness level the lower your heart rate. Exercise increases the muscles of the heart which means that the heart can pump more blood with each contraction. A stronger heart means a lower resting heart rate since fewer beats are needed to circulate the same amount of blood.

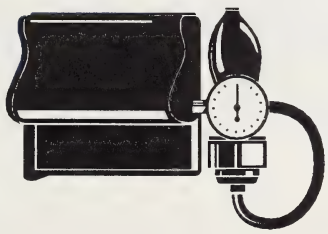
3. Your resting heart rate should decrease. When you exercise and get stronger, your heart also works harder and gets stronger. A stronger heart is more efficient and fewer beats per minute are needed.

4. There may or may not be a difference in your initial and recovery heart rates. If you are in good physical shape, your body should recover from the step test after two minutes. If you are not in good physical shape, your body will take longer to recover and your recovery heart rate will still be higher than your initial heart rate.

5. Strenuous exercise, such as the step test, should produce other changes in body functions. Your working muscles produce heat which must be gotten rid of. Sweating is one way of reducing body temperature. Your muscles also use oxygen when contracting so your breathing rate will increase, to obtain more oxygen for the cells of your body. If you are in poor physical condition, your body may not be able to complete the step test. Your muscles will become weak and your legs heavy, forcing you to stop before the 2 minutes are up.

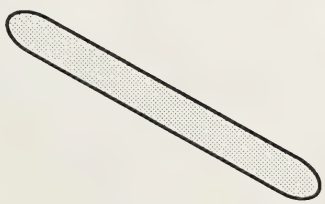
Section 1: Activity 2

1. **e**



a. Otoscope – used to examine the eardrum for signs of infection

d



b. Stethoscope – used to listen to heart and lung sounds

b

c. Patella hammer – used to test the reflex response of the nerves in the lower leg

a

d. Tongue depressor – used to examine your tonsils and throat for signs of infection

c

e. Sphygmomanometer – used to measure your blood pressure

2. You should be able to hear the person's heart beating. The sound should be a muffled two-part beat, a "lub" and a "dub." These sounds are the closing of valves in different parts of the heart. You might also hear breathing.

Investigation: Using the Stethoscope

3. You should hear two sounds, fairly close together. A "lub" and then a "dub" are the sounds of the valves in your heart closing.

4. Your heart should be beating more rapidly and with a stronger beat. Your heartbeat should be louder after exercising for one minute.

5. You should hear air rushing into the lungs when the person inhales and air rushing out of the lungs when the person exhales.

6. You should not hear anything. Blood flowing normally in your arteries does not make any sounds.

7. By constricting blood flow in the artery you should be able to hear a swishing sound. Blood flowing past the constricted area makes the sound.

8. Sound is collected and amplified by the body contact piece of stethoscope. This sound is transferred to the earpieces through hollow tubing. When you have the earpieces in your ears it creates a "direct line" for sounds coming from your body.

9. Body sounds that you can hear using the stethoscope include

    - the heartbeat
    - air moving into and out of the lungs
    - blood flowing in the arteries

    You may also hear intestinal contractions (stomach rumbling), the grinding of teeth, a swallow, or the vibrations of the larynx when talking or humming.

10. Your blood pressure would be $\frac{\text{systolic (higher pressure)}}{\text{diastolic (lower pressure)}} = \frac{120}{80}$.

11. A blood pressure reading of 140/90 would be considered high for an 18-year-old student who is rested and relaxed. If the student were under stress or had just completed a strenuous physical workout, then the blood pressure reading may not be considered high. Normal blood pressure values are recorded when individuals are rested and relaxed.

12.

Factors	Effects on Blood Pressure
Age	Arteries lose their elasticity as you grow older. Your arteries may also become constricted as fatty deposits build up on the inside walls. Both of these factors will increase blood pressure levels.
Body Mass	Increased body mass requires more blood and blood vessels to supply all areas with blood. The heart must work harder to circulate blood throughout the body, increasing blood pressure.
Physical Activity	Increased heart rates during exercise result in increased blood pressure. Exercise can, however, strengthen the heart making it more efficient. A more efficient heart will beat less often when a person is resting resulting in lower blood pressure.
Stress	Emotional stress or tension brings about a response similar to exercise. Your heart rate increases, muscles tense, and blood pressure increases.
Smoking	Chemicals in cigarette smoke are absorbed into your bloodstream. These chemicals cause a reduction in the diameter of your blood vessels, increasing blood pressure.

13. Bill Waters probably has high blood pressure because

- smoking causes a constriction of blood vessels, increasing blood pressure
- extra mass requires the heart to work harder to supply all regions of his body with blood, increasing blood pressure
- stress also causes his heart to work harder, increasing blood pressure

Section 1: Activity 3

1. a. ___e___ Muscular system

   b. ___c___ Nervous system

   c. ___b___ Circulatory system

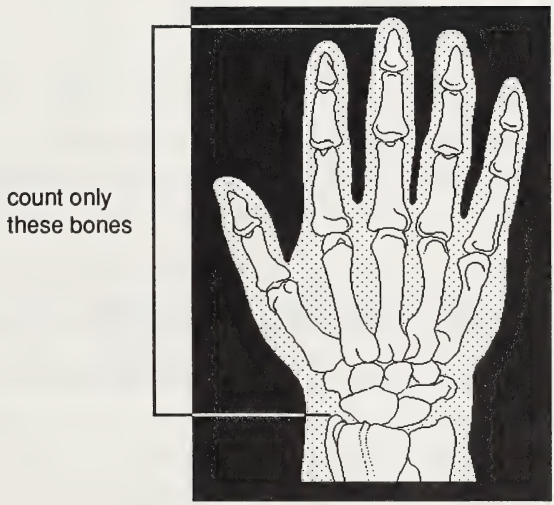
   d. ___f___ Digestive system

   e. ___a___ Skeletal system

   f. ___d___ Hormonal system

2. There are five bones in the palm of your hand.

3. Your entire hand is made up of twenty-six bones.



4. Your thumb has two bones, one less than your other four fingers.

5. No, the number of bones in the hand does not change.

6. The only difference is that the middle bone of the little finger is broken in this x-ray.

7. The PET scanner should be used to examine blood flow in the muscle tissue of the heart. The PET scanner will detect more radioactive material in areas with normal blood supply than in areas with restricted blood flow.

8. The PET scanner uses radioactive material to monitor cellular activity within the body.

Section 1: Follow-up Activities

Extra Help

1. a. False – Wilhelm Röntgen produced the first x-ray photograph.

   b. True

   c. True

   d. False – An EKG provides your doctor with a reading of heart activity.

   e. True

   f. True

   g. False – A dynamometer is used to measure muscle strength.

   h. True

   i. True

   j. False – Hypertension has often been called the silent killer because it has no symptoms.

   k. False – The stethoscope is used to listen to heart and lung sounds.

Section 2: Activity 1

Investigation: Are You Sweating?

STEP C

OBSERVATION

Count the number of times you exhale (breathe out) in 1 minute. Record this value as your breathing rate.

_____ breaths per minute

Next, feel your armpit.
Does it feel warmer than usual?

✓ Yes _____ No

Are you sweating?

✓ Yes _____ No

STEP D

OBSERVATION

Resting Breath Rate

= _____ breaths/minute

Your resting breath rate should be lower, about 15-20 breaths/minute.

1. Your breathing rate increases with exercise. As you exercise, your muscles burn fuel (glucose) and use up oxygen. Your breathing rate increases to provide more oxygen to the muscle cells.

2. As you exercise, your working muscles produce heat. A certain amount of heat is necessary to maintain your body temperature, but too much heat can cause problems. Excess heat is carried by the blood to the skin's surface. Sweating is a cooling down mechanism for the body. Sweat evaporates from the surface of the skin, taking excess body heat with it.

3. Body systems can shut down if pushed beyond normal limits. Muscles will cramp or seize up, preventing further use. You may also faint or pass out, because of a lack of oxygen being supplied to the brain. Fainting allows the lungs and circulatory system to resupply all vital organs with blood glucose (fuel) and oxygen.

Section 2: Activity 2

1. First check the injured person for bluish or cold limbs, pain in the pelvis or thighs, or signs of shock (pale skin, sweating, thirstiness, or dizziness). If the person has any of these symptoms, get medical help immediately. You should also check for a lot of bruising or bleeding, crookedness of any limb, and the inability of any limb to bear weight. If the person has any of these symptoms, then you should get medical help. Otherwise, you can treat the person using RICE.

2. RICE is the acronym for

   Rest – Do not use the injured limb.

   Ice – Apply ice for 20 minutes every 2 hours.

   Compression – Wrap the injured area with a tensor bandage.

   Elevation – On a pillow keep the limb as high as comfortable.

3. This is a compound fracture. The broken bone is protruding through the surface of the skin.

4. No, the fracture has not healed properly. The bones should be straight, not bent at the point of the break.

5. Ben's fracture has not healed properly. The doctor must rebreak the bones, realign, and set them again.

Section 2: Activity 3

1. Yes, you should get Wayne to the hospital immediately. The chest and shoulder pain, weakness, and sweaty condition all point to a heart attack.

2. No, the heart does not obtain any oxygen or nutrients from the blood that it pumps throughout the body. The heart gets its nutrients and oxygen from the blood carried by the coronary arteries.

3. Yes, the heart attack would be fatal. The blockage at Point A would prevent blood from reaching the entire right side of the heart, an area too large to lose.

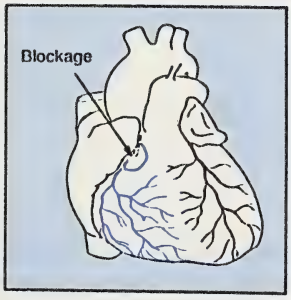
4. Both heart attacks and strokes are the result of obstructions in arteries. The difference is in the location of the obstruction: blockage of coronary arteries leads to heart attacks and blocking the blood flow the brain results in a stroke.

5. The three uncontrollable risk factors are

   - heredity – You are at greater risk of heart attack if one or more of your relatives has had heart or circulatory problems.
   - gender – Middle-aged men are more at risk than middle-aged women.
   - age – The risk of heart attack increases with age for both men and women.

6. **e**

a



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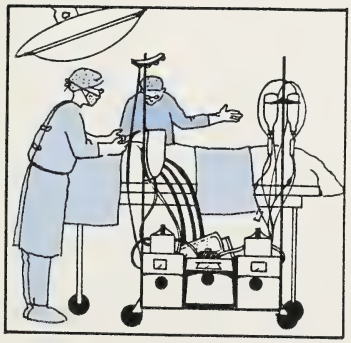


a. Coronary Bypass – A new vein is used to go around a blockage.

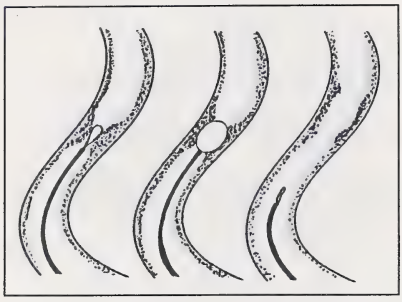
b. Balloon Angioplasty – A **catheter** with a balloon on the end is threaded through a vein to the heart. The balloon is inflated to compress the plaque against the artery wall, widening the opening for blood flow.

c. Laser Surgery – A microlaser contained in a catheter is inserted in a vein and moved to the blockage. The laser burns away the blockage.

d. Heart/Lung Machine – a machine which can take over heart and lung functions for a short period of time

e. Drugs – chemicals introduced into your system to dissolve the blockage

b



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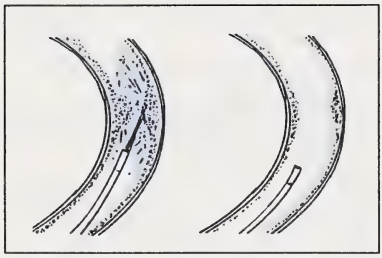
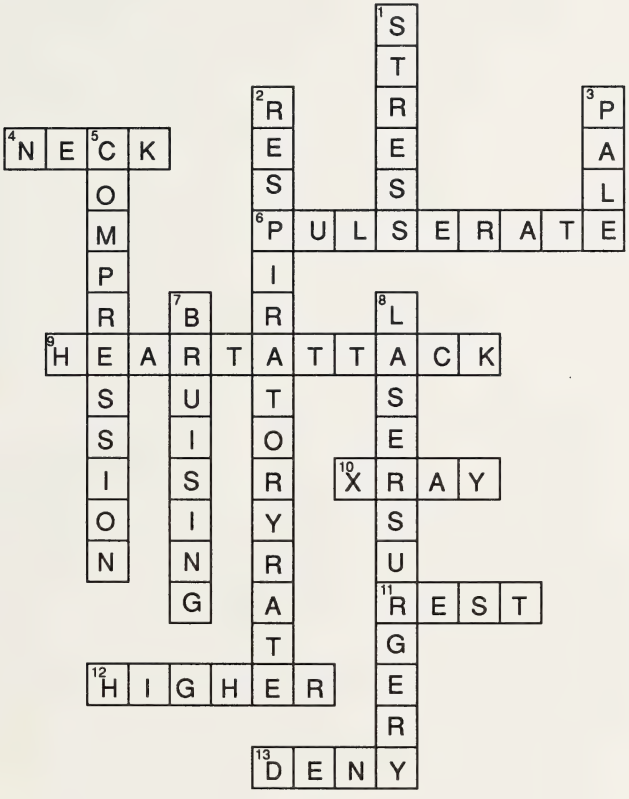


7. No, artificial pacemakers are not required by all heart attack victims. An artificial pacemaker is only needed when the heart attack damaged the cells of the heart's natural pacemaker.

Section 2: Follow-up Activities

Extra Help

Your completed crossword should be as follows:



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